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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/010,083	11/09/2001	Liliya Fedorovna Gorina	VALER6.001C1	3215

20995 7590 06/04/2002

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EXAMINER

Edmondson, Lynne Renee

ART UNIT	PAPER NUMBER
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1725

DATE MAILED: 06/04/2002

4

Please find below and/or attached an Office communication concerning this application or proceeding.

# Office Action Summary

Application No.

10/010,083

Applicant(s)

GORINA ET AL.

Examiner

Lynne Edmondson

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

## Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

## Status

- 1) ☒ Responsive to communication(s) filed on 09 November 2001.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

## Disposition of Claims

- 4) ☒ Claim(s) 1-56 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-16, 18-22, 24, 30, 32--35, 37, 38, 40, 41 and 44-56 is/are rejected.
- 7) ☒ Claim(s) 17, 23, 31, 36, 39, 42 and 43 is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

## Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 09 November 2001 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on \_\_\_\_\_ is: a) ☐ approved b) ☐ disapproved by the Examiner.  
If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

## Priority under 35 U.S.C. §§ 119 and 120

- 13) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).  
a) ☐ All b) ☒ Some \* c) ☐ None of:  
1. ☒ Certified copies of the priority documents have been received.  
2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.  
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).  
\* See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).  
a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

## Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892) 4) ☐ Interview Summary (PTO-413) Paper No(s). \_\_\_\_\_
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948) 5) ☐ Notice of Informal Patent Application (PTO-152)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) \_\_\_\_\_ 6) ☐ Other: \_\_\_\_\_

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## DETAILED ACTION

### *Claim Rejections - 35 USC 112*

The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

1. Claims 1-5 recite the limitation of a material containing the metal Gr. There is no Gr element in the periodic table. The organic formula contains a subscript a but does not give a range for a. A range is given for n but there is no subscript n. It is presumed that  $n = a$  in this case. However, this is not clear. Appropriate correction is required.
2. Claims 12-24 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

The parent claim (12) recites an undefined metal-organic for use in manufacturing the electrolyte which is mixed with metal carboxylates or metal alcoholates containing undefined metals which may be the same or may be different. A metal or group of metals should be defined to clarify the boundaries of the claim. Appropriate correction is required.

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3. Claims 15-17 and 19 recite the limitation "the step of synthesizing the zirconium alcoholate" in line 2 of claim 15. There is insufficient antecedent basis for this limitation in the claim. The parent claim does not teach Zr. Appropriate correction is required.

4. Claims 20 and 21 recite the limitation "the modified zirconium dioxide" in lines 2-3 of claim 20 and line 2 of claim 21. There is insufficient antecedent basis for this limitation in the claim. The parent claim does not teach Zr. Appropriate correction is required.

5. Claims 22 and 30 recites the limitation "the inert medium" in lines 1-2. There is insufficient antecedent basis for this limitation in the claim. Appropriate correction is required.

6. Claim 29 recites the limitation "the air medium" in line 2. There is insufficient antecedent basis for this limitation in the claim. Appropriate correction is required.

7. Claim 28 recites the limitation " the concentration of CR, La, Sr, Mg, Ca in the mixture of liquid carboxylates" in lines 1-2. There is insufficient antecedent basis for this

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limitation in the claim. None of these elements are in parent claim 25. Appropriate correction is required.

8. Claim 47 recites the limitation " said liquid carboxylates" in line 2. There is insufficient antecedent basis for this limitation in the claim. Appropriate correction is required.

***Claim Rejections - 35 USC 102***

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless --

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

(e) the invention was described in a patent granted on an application for patent by another filed in the United States before the invention thereof by the applicant for patent, or on an international application by another who has fulfilled the requirements of paragraphs (1), (2), and (4) of section 371 of this title before the invention thereof by the applicant for patent.

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9. Claims 6, 7 and 11 are rejected under 35 U.S.C. 102(b) as being anticipated by Pederson et al. (USPN 5114702).

Pederson teaches a method of manufacturing a ceramic cathode comprising precipitation of lanthanum and manganese nitrates in combination with metals including La, Mn, Ni, Cr, and Co (col 3 lines 30-44) and metal carboxylates (col 4 lines 5-21). Among the many combinations which may be formed are LaSrMnO<sub>3</sub> and LaSrCrO<sub>3</sub> (col 5 lines 15-34). The mixture is heated at a temperature less than 1380 C (700 C) (col 5 lines 5-14). Compounds are typically pressed into a pellet form prior to sintering (col 7 lines 16-20). See also Pederson claims 1, 3, 5-8, 12 and 17-19.

10. Claims 1-5, 12-15, 24-29, 33-35, 37, 38, 40, 41, 44-47, 52, 54 and 56 are rejected under 35 U.S.C. 102(e) as being anticipated by Mukherjee et al. (USPN 5919587).

Mukherjee teaches a method of manufacturing a fuel cell comprising formation of an electrolyte, cathode and anode as well as additional layers which would include an interface (catalyst) layer, insulating layer and current passage (separator) (col 11 line 62 - col 12 line 4). The materials are made using the same apparatus wherein cell components are formed from a metal-organic complex containing a transition metal from the group including but not limited to Ti, Co, Ni, Hf and Zr. The organometallic has the common formula (CH<sub>3</sub>-CH<sub>2</sub>-CO<sub>2</sub>)<sub>n</sub>Me wherein n is a number ranging from 0 to 72

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and Me is a transition metal which will have a valence. Cobalt is typically 3 or 4. The mixture is initially heated to 100 C in the presence of a mineral acid or alcohol (col 12 lines 5-64 and col 21 lines 46-56) reacted with a Zr salt (col 5 lines 26-46 and lines 55-65). Note that the common formula is an organic functional group which can be combined in a variety of forms. The metal organic is used as a binder for forming the cathode mass (col 21 lines 18-27) and is used as the liquid phase carrier for mixing (col 22 lines 1-36). Combinations of Y and Zr are used as electrolyte materials and doped zirconia (such as YSZ) is a well-known electrolyte material. The metal content in the carboxylate is between 2 and 40 wt% that is between 20 and 400g per kg (col 10 lines 9-26). See Mukherjee claims 1-3, 7-9, 38-40 and 51.

11. Claims 6, 8-10, 25, 27-30 and 32 are rejected under 35 U.S.C. 102(e) as being anticipated by Zhen et al. (USPN 6093234).

Zhen teaches a method of making a fuel cell component layers including current passage and interfacial layers by synthesizing a doped lanthanum chromite which is dispersed, ground, mixed in an organic carrier, deposited on a cathode foam and sintered to form a film (coating) (col 2 lines 32-49). The mixture comprises 4% binder (1g of 22.5g in Example XVIII). The ratio between solid and liquid phases is within the range 1/100 and 15/100. The metal concentration is 50g per kg of nitrates. However, it is taught that carboxylates and carboxylic acids may be used in a similar processes (col

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1 lines 46-60) and the mixture may be sprayed (col 3 lines 40-48). Deposition (typically painting or printing) occurs in air (col 7 line 65 - col 8 line 34 and col 3 lines 3-34) but can be performed in any desired atmosphere including reducing and inert (col 7 lines 47-50 and col 8 lines 31-35). Materials are formed at low temperatures such as 200 C and 400 C (col 3 line 17 and col 4 lines 30-32). Zr alcoholates may be formed and mixed at an initial temperature below 100 C (col 1 lines 36-60). Firing temperatures are dependent upon the materials employed and desired density however an example is taught wherein nitrates are jointly precipitated, pressed and heated to 1250 and 1350 C (col 8 lines 58-64 and col 12 lines 50-65) but can be as low as 400 C (col 4 lines 22-35). A cermet layer comprising Ni or cobalt may be employed to form the fuel electrode (col 4 lines 47-56, col 9 lines 26-45 and col 11 lines 10-35)

12. Claims 25, 27, 29, 40, 44, 46 and 48 are rejected under 35 U.S.C. 102(e) as being anticipated by Xue (USPN 5702837).

Xue teaches a method of synthesizing a doped lanthanum chromite current passage and porous nickel cermet fuel electrode (col 1 lines 13-26). Organometallic mixtures are dispersed and mixed with an organic carrier (binder) and deposited on the cathode and electrolyte respectively after which the assembly is thermally treated for forming. Ni and ZrO<sub>2</sub> are added in equal amounts (col 3 lines 5-52). The ratio of solid and liquid phases is between 1/3 and 6/1 (col 4 lines 28-36). The metal in the cermet is



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nickel or cobalt (col 3 lines 6-10) and is mixed with rough dispersed ion conductive material (ZrO<sub>2</sub>) and 2-20% binder (col 3 line 53 - col 4 line 17). The material is typically deposited as a paste, by brushing or spraying under ambient conditions (col 6 lines 58-64). Ni:Zr ratio is about 1.1:1.0 at the high end of the range (col 3 lines 53-60). Parts are pressed and heated to a temperature below 1350 C (col 3 lines 53-65).

***Claim Rejections - 35 USC 103***

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

13. Claims 8-10 are rejected under 35 U.S.C. 103(a) as being unpatentable over Pederson et al. (USPN 5114702) in view of Mukherjee et al. (USPN 5919587).

Pederson teaches a method of manufacturing a ceramic cathode comprising precipitation of lanthanum and manganese nitrates in combination with metals including La, Mn, Ni, Cr, and Co (col 3 lines 30-44) and metal carboxylates (col 4 lines 5-21). Among the many combinations which may be formed are LaSrMnO<sub>3</sub> and LaSrCrO<sub>3</sub> (col

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5 lines 15-34). The mixture is heated at a temperature less than 1380 C (700 C) (col 5 lines 5-14). Compounds are typically pressed into a pellet form prior to sintering (col 7 lines 16-20). See also Pederson claims 1, 3, 5-8, 12 and 17-19. However, there is no disclosure of binder content or metal ratio in the organic.

Mukherjee teaches a method of manufacturing fuel cell components comprising a metal-organic complex containing a transition metal from the group including but not limited to Ti, Co, Ni, Hf and Zr. The organometallic has the common formula  $(CH_3-CH_2-CO_2)_nMe$  wherein n is a number ranging from 0 to 72 and Me is a transition metal which will have a valence (col 12 lines 5-64). Note that the common formula is an organic functional group which can be combined in a variety of forms. The metal organic is used as a binder for forming the cathode mass (col 21 lines 18-27) and binder is added in an amount less than 10% (col 21 lines 1-10). The metal content in the carboxylate is preferably between 5 and 40 wt% that is between 5 and 400g per kg (col 10 lines 9-26). See Mukherjee claims 1-3, 7-9, 38-40 and 51.

It would have been obvious to one of ordinary skill in the art at the time of the invention to use a small amount of binder to facilitate sintering and maintain strength (Pederson, col 1 lines 24-39 and col 2 lines 43-49) and incorporate at least 20g of metal per kilogram of organic material to maintain stoichiometry and good electrical properties (Pederson, col 6 lines 65-69).

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14. Claims 16, 18, 19, 32, 53 and 55 are rejected under 35 U.S.C. 103(a) as being unpatentable over Mukherjee et al. (USPN 5919587) in view of Zhen et al. (USPN 6093234).

Mukherjee teaches a method of manufacturing a fuel cell comprising formation of an electrolyte, cathode and anode as well as additional layers which would include an interface (catalyst) layer, insulating layer and current passage (separator) (col 11 line 62 - col 12 line 4). The materials are made using the same apparatus wherein cell components are formed from a metal-organic complex containing a transition metal from the group including but not limited to Ti, Co, Ni, Hf and Zr. The organometallic has the common formula  $(CH_3-CH_2-CO_2)_nMe$  wherein n is a number ranging from 0 to 72 and Me is a transition metal which will have a valence. Cobalt is typically 3 or 4. The mixture is initially heated to 100 C in the presence of a mineral acid or alcohol (col 12 lines 5-64 and col 21 lines 46-56) reacted with a Zr salt (col 5 lines 26-46 and lines 55-65). Note that the common formula is an organic functional group which can be combined in a variety of forms. The metal organic is used as a binder for forming the cathode mass (col 21 lines 18-27) and is used as the liquid phase carrier for mixing (col 22 lines 1-36). Combinations of Y and Zr are used as electrolyte materials and doped zirconia (such as YSZ) is a well known electrolyte material. The metal content in the carboxylate is between 2 and 40 wt% that is between 20 and 400g per kg (col 10

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lines 9-26). Although it is taught that materials are applied at temperatures greater than 100 degrees this temperature is not further disclosed.

Zhen teaches a method of making a fuel cell component layers including current passage and interfacial layers by synthesizing a doped lanthanum chromite which is dispersed, ground, mixed in an organic carrier, deposited on a cathode foam and sintered to form a film (coating) (col 2 lines 32-49). Materials are formed at low temperatures such at 200 C and 400 C (col 3 line 17 and col 4 lines 30-32). Zr alcoholates may be formed and mixed at an initial temperature below 100 C (col 1 lines 36-60). Firing temperatures are dependent upon the materials employed and desired density however an example is taught wherein nitrates are jointly precipitated, pressed and heated to 1250 and 1350 C (col 8 lines 58-64 and col 12 lines 50-65) but can be as low as 400 C (col 4 lines 22-35). The mixture comprises 4% binder (1g of 22.5g in Example XVIII). The ratio between solid and liquid phases is within the range 1/100 and 15/100. The metal concentration is 50g per kg of nitrates. However, it is taught that carboxylates and carboxylic acids may be used in a similar processes (col 1 lines 46-60) and the mixture may be sprayed (col 3 lines 40-48). Deposition (typically painting or printing) occurs in air (col 7 line 65 - col 8 line 34 and col 3 lines 3-34) but can be performed in any desired atmosphere including reducing and inert (col 7 lines 47-50 and col 8 lines 31-35). A cermet layer comprising Ni or cobalt may be employed to form the fuel electrode (col 4 lines 47-56, col 9 lines 26-45 and col 11 lines 10-35).

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It would have been obvious to one of ordinary skill in the art at the time of the invention to optimize processing temperatures for the materials employed to enhance ionic transport and prevent large increases in internal cell resistance (Mukherjee, col 3 lines 24-31).

15. Claims 20-22, 30, 49, 50 and 51 are rejected under 35 U.S.C. 103(a) as being unpatentable over Mukherjee et al. (USPN 5919587) in view of Bickmore et al. (USPN 5984997).

Mukherjee teaches a method of manufacturing a fuel cell comprising formation of an electrolyte, cathode and anode as well as additional layers which would include an interface (catalyst) layer, insulating layer and current passage (separator) (col 11 line 62 - col 12 line 4). The materials are made using the same apparatus wherein cell components are formed from a metal-organic complex containing a transition metal from the group including but not limited to Ti, Co, Ni, Hf and Zr. The organometallic has the common formula  $(CH_3-CH_2-CO_2)_nMe$  wherein n is a number ranging from 0 to 72 and Me is a transition metal which will have a valence. Cobalt is typically 3 or 4. The mixture is initially heated to 100 C in the presence of a mineral acid or alcohol (col 12 lines 5-64 and col 21 lines 46-56) reacted with a Zr salt (col 5 lines 26-46 and lines 55-65). Note that the common formula is an organic functional group which can be combined in a variety of forms. The metal organic is used as a binder for forming the

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cathode mass (col 21 lines 18-27) and is used as the liquid phase carrier for mixing (col 22 lines 1-36). Combinations of Y and Zr are used as electrolyte materials and doped zirconia (such as YSZ) is a well known electrolyte material. The metal content in the carboxylate is between 2 and 40 wt% that is between 20 and 400g per kg (col 10 lines 9-26). The atmosphere may be air, reducing or inert. However, material particle size and shape are not disclosed. Neither is Ce oxide disclosed.

Bickmore teaches synthesis of electrode materials comprising Ni, Co, Ce and Zr oxides having particle size less than 2 microns (nanometers, col 2 lines 20-25 and lines 42-65, col 4 lines 22-35) in an inert atmosphere comprising nitrogen or argon (col 5 lines 19-25 and col 6 lines 1-13). Particles may have a thread like (whisker) shape or be spherical (col 6 lines 56 col 7 line 5).

It would have been obvious to one of ordinary skill in the art at the time of the invention that Ce oxides are equivalents for Zr oxides in fuel cell materials. By using materials with small particle size in an inert atmosphere, corrosion is prevented (Mukherjee, col 3 lines 23-31) while improving cell efficiency and utilization (Mukherjee, col 4 lines 52-61).

Applicant cannot rely upon the foreign priority papers to overcome this rejection because a translation of said papers has not been made of record in accordance with 37 CAR 1.55. See MPEP, 201.15.

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16. Claims 20-22, 30, 49, 50 and 51 are rejected under 35 U.S.C. 103(a) as being unpatentable over Mukherjee et al. (USPN 5919587) in view of Jensen (USPN 5141825).

Mukherjee teaches a method of manufacturing a fuel cell comprising formation of an electrolyte, cathode and anode as well as additional layers which would include an interface (catalyst) layer, insulating layer and current passage (separator) (col 11 line 62 - col 12 line 4). The materials are made using the same apparatus wherein cell components are formed from a metal-organic complex containing a transition metal from the group including but not limited to Ti, Co, Ni, Hf and Zr. The organometallic has the common formula  $(CH_3-CH_2-CO_2)_nMe$  wherein n is a number ranging from 0 to 72 and Me is a transition metal which will have a valence. Cobalt is typically 3 or 4. The mixture is initially heated to 100 C in the presence of a mineral acid or alcohol (col 12 lines 5-64 and col 21 lines 46-56) reacted with a Zr salt (col 5 lines 26-46 and lines 55-65). Note that the common formula is an organic functional group which can be combined in a variety of forms. The metal organic is used as a binder for forming the cathode mass (col 21 lines 18-27) and is used as the liquid phase carrier for mixing (col 22 lines 1-36). Combinations of Y and Zr are used as electrolyte materials and doped zirconia (such as YSZ) is a well known electrolyte material. The metal content in the carboxylate is between 2 and 40 wt% that is between 20 and 400g per kg (col 10

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lines 9-26). The atmosphere may be air, reducing or inert. However, material particle size and shape are not disclosed. Neither is Ce oxide disclosed.

Jensen teaches synthesis of electrode materials comprising modified Zr oxides having particle size less than 2 microns present in an amount of about 1% (col 3 lines 9-19). Ni and Co particles are spherical with a diameter of 3 to 7 microns (col 3 lines 62-67). Particles may also have a thread like (filamentary) shape (col 3 lines 12-15 and col 4 lines 35-46). CeO<sub>2</sub> may be used as a substitute for ZrO<sub>2</sub> (col 5 lines 47-50). Processing may be performed in an inert atmosphere such as N<sub>2</sub> (col 7 lines 50-60).

It would have been obvious to one of ordinary skill in the art at the time of the invention that Ce oxides are equivalents for Zr oxides in fuel cell materials. By using materials with small particle size in an inert atmosphere, corrosion is prevented (Mukherjee, col 3 lines 23-31) while improving cell efficiency and utilization (Mukherjee, col 4 lines 52-61).

### ***Allowable Subject Matter***

17. Claims 17, 23, 31, 36, 39, 42 and 43 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.



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The following is a statement of reasons for the indication of allowable subject matter: There is no disclosure of the claimed organic formula used in combination with lanthanide materials particularly BaCeGd oxide or SrCeGd oxide. Neither do the references teach a quantitative growth rate, sintering or thermal formation at a temperature under 400 C in an inert atmosphere to force a particular film thickness. See also Spiewak et al. (USPN 6136412), Debe (USPN 6040077) and Marchetti et al. (USPN 5277996).

### ***Conclusion***

18. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. Yao et al. (USPN 6183914 B1), Lawate (USPN 5681797), Mackay et al. (USPN 6146549, current passage), Carter (USPN 580934, current passage), Nunan et al. (USPN 6013313), Leedham et al. (USPN 5504195), Matsuzaki (USPN 5474800), Wallin (USPN 6017647), Stephenson (USPN 5534468) and Sugikawa (USPN 6080357).

19. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Lynne Edmondson whose telephone number is

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(703) 306-5699. The examiner can normally be reached on M-F from 7-4 with alternate Fridays off.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Tom Dunn can be reached on (703) 308-3318. The fax phone numbers for the organization where this application or proceeding is assigned are (703) 305-7118 for regular communications and (703) 305-7115 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 308-0651.

Lynne Edmondson  
Examiner  
Art Unit 1725

LRE  
May 29, 2002

  
TOM DUNN  
SUPERVISORY PATENT EXAMINER  
TECHNOLOGY CENTER 1700